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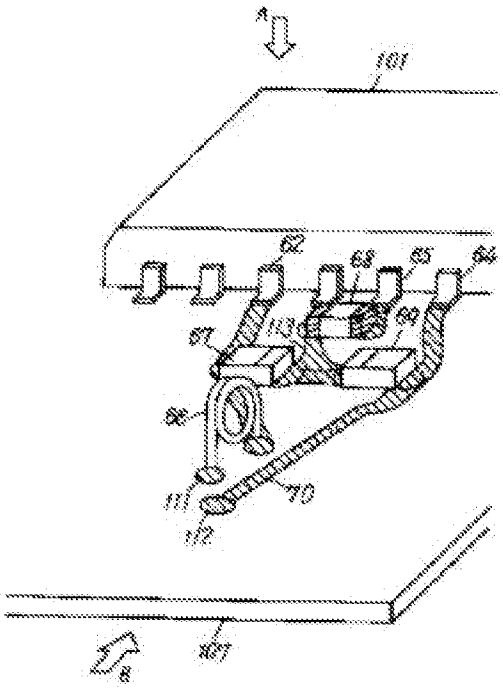
(54) BALANCED OSCILLATOR AND HIGH FREQUENCY DEVICE USING THE SAME

(57)Abstract:
PURPOSE: To improve adjustment accuracy and to reduce spurious radiation or reception by forming first and second inductance by a coil and a printed pattern and oppositely arranging them to provide mutual inductance between them.

CONSTITUTION: On a printed board 107, an IC 101 provided with a balanced type oscillation circuit 71, a coil 66 for adjustment composed of the coil connected between the first output terminal 62 of the IC 101 and a first ground pattern 111, a tuning pattern 70 composed of the printed pattern connected between a second output terminal 64 and a second ground pattern 112 and a serial circuit of vari-cap diodes 67 and 69 whose cathodes are connected each other between the first output terminal 62 and the second output terminal 64 are connected. Thus, the mutual inductance M generated between the coil 66 for the adjustment and the pattern 70 is varied by inclining the coil 66 for the adjustment towards the tuning pattern 70 and an oscillation frequency is adjusted without almost breaking the balance of a tuning circuit.



CLAIMS

[Claim(s)]
[Claim 1]Have a balanced type oscillating circuit and a tuned circuit established in an output side of this balanced type oscillating circuit, and said tuned circuit, A coil for adjustment which consists of a winding coil connected between the 1st output terminal of said balanced type oscillating circuit, and the 1st ground, A pattern for alignment which consists of a print pattern connected between the 2nd output terminal of said balanced type oscillating circuit, and the 2nd ground, It has the capacitance connected between said 1st output terminal and said 2nd output terminal, A balanced type oscillator which gave a mutual inductance between said coil for adjustment, and said pattern for alignment, changed said mutual inductance with said coil for adjustment, and enabled adjustment of oscillating frequency.
[Claim 2]The balanced type oscillator according to claim 1 which arranged an earth pattern on the opposite side side while forming a pattern for alignment which becomes one side of a printed circuit board from a print pattern.
[Claim 3]A high frequency device comprising:
An input terminal.
A down converter part connected to this input terminal.
A demodulation section connected to this down converter part.
It has an output terminal connected to this demodulation section, and is the balanced type oscillator according to claim 1 in said demodulation section.

[Claim 4]A high frequency device comprising:
An input terminal.
A down converter part connected to this input terminal.
A demodulation section connected to this down converter part.
It has an output terminal connected to this demodulation section, and is the balanced type oscillator according to claim 2 in said demodulation section.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to a balanced type oscillator and the high frequency device which used it.
[0002]

[Description of the Prior Art]The conventional balanced type oscillator is explained below.
[0003]The conventional oscillator was constituted as shown in drawing 10. Namely, IC501 which includes a balanced type oscillating circuit on the printed circuit board 507, The 1st coil 505 for adjustment provided between the 1st output terminal 508 of this IC501, and the 1st earth pattern 511, The 2nd coil 506 for adjustment provided between the 2nd output terminal 510 of said IC501, and the 2nd earth pattern 512, The series circuit with the two varicap diodes 503 and 504 which connected cathodes between said 1st output terminal 508 and the 2nd output terminal 510 was arranged.
[0004]The resistance 502 was formed between the node 513 of these two varicap diodes 503 and 504, and the voltage control terminal 509 of said IC501.
[0005]And adjustment of this oscillating frequency was performed by adjusting the interval of said 1st coil 505 for adjustment, and said 2nd coil 506 for adjustment, and changing a mutual inductance.
[0006]The situation of adjustment with the coil for adjustment in the conventional oscillator is explained to drawing 11 (a), (b), (c), and (d).
[0007]At drawing 11 (a), the state where drawing 10 was seen from the upper surface A is shown, and drawing 11 (b) shows the state where drawing 10 was seen from the side B.
[0008]The earth pattern 557 of the printed circuit board 507 is soldered to the metallic frame 555 by drawing 11 (a) and (b), Forming the 1st coil 505 for adjustment, and the 2nd coil 506 for adjustment in said substrate 507, said metallic frame 555 was covered with the coverings 554 and 558, and has established the covering hole 551 for coil adjustment in this covering 554.
[0009]While said 1st coil 505 for adjustment and said 2nd coil 506 for adjustment make a roller a uniform direction mostly and arrange it at this time, The outer diameter P of this 1st alignment coil 505 and the 2nd coil 506 for adjustment presupposes that it is the same in abbreviation, sets the interval U of this 1st alignment coil 505 and the 2nd coil 506 for adjustment to two in about 1/of the outer diameter P of said 1st coil 505 for adjustment, and is giving mutual-inductance M mutually.
[0010]Drawing 11 (c) and (d) shows the state after adjustment with these two coils for adjustment.
[0011]If the 1st coil 505 for adjustment is leaned to the direction of the 2nd coil 506 for adjustment and both interval is adjusted in drawing 11 (c) and (d), Oscillating frequency can be adjusted, while the mutual inductance of both said 1st coil 505 for adjustment and said 2nd coil 506 for adjustment can fluctuate only **M and maintains the balance of an oscillator.
[0012]The variable range of oscillating frequency with said 1st coil 505 for adjustment is about 35 MHz, and to 10 MHz of an actually required variable range, although it is sufficient value, specifically, Mutual mutual-inductance M was large, change **M of the mutual inductance at the time of coil adjustment became large, the variation of frequency became large as a result, and fine adjustment of oscillating frequency was difficult.
[0013]Although it is possible to extend the interval U of said 1st coil 505 for adjustment, and said 2nd coil 506 for adjustment in drawing 11 (b) as one of the improving method of this, For example, in order to set the variable range of oscillating frequency with said 1st coil 505 for adjustment to two in about 1/from conventional 35 MHz, The interval U of said 1st coil 505 for adjustment and said 2nd coil 506 for adjustment must be extended from 0.5 time from an experiment 1.25 times and about 2.5 times to the outer diameter P of said 1st coil 505 for adjustment.
[0014]That is, a space will be occupied more greatly on a printed circuit board than a

conventional example. By radiation of the oscillation ingredient from the coil for adjustment, the sensitivity of a BS tuner is lowered, for example, or noise volume was enlarged and performance was degraded.
[0015]When adjusting one coil for adjustment with a regulating rod, it hits the coil for adjustment of another side, It is necessary to enlarge the covering hole 551 for said coil adjustment for adjusting these two coils 505,506 for adjustment more than twice [further / about], and it is influenced to the exterior of a BS tuner by the spurious radiation and diving by this covering hole 551, or gives.
[0016]
[Problem(s) to be Solved by the Invention]In such conventional composition, by radiation of the oscillation ingredient from the coil 505,506 for adjustment, the sensitivity of a BS tuner is lowered, for example, or noise volume was enlarged and performance was degraded.
[0017]Since a regulating rod is put into the covering hole 551 for coil adjustment, a mutual inductance is changed by the interval of the two coils 505,506 for adjustment at the time of adjustment and oscillating frequency is adjusted, change the coil for adjustment of an adjusting side, or, Since it was hard to double the variation to the oscillating frequency at the time of coil adjustment with large predetermined oscillating frequency again, the man day had started.
[0018]Therefore, this covering hole 551 was the issue which it must be large for adjustment of a coil, must be made small in order for disturbance by spurious radiation and diving to be generating in one side, and must be solved. Then, adjustment accuracy of this invention is high and it aims at moreover providing what has few spurious radiation and diving.
[0019]
[Means for Solving the Problem]In order to attain this purpose, while using the 1st inductance as a coil for adjustment which consists of a winding coil in a tuned circuit of an oscillator of this invention and forming the 2nd IDANKU wardrobe by a pattern for alignment which consists of print patterns, It is made to counter so that it may have a mutual inductance between said 1st inductance and said 2nd inductance, and arranges.
[0020]
[Function]Since the 1st inductance is used as a winding coil and the 2nd inductance is formed with the print pattern from this composition, Adjustment of oscillating frequency is possible for the coil for adjustment seen from the covering hole, without becoming one piece and caring about the coil for adjustment of another side like before, and since variation to the oscillating frequency at the time of coil adjustment can be made small, by a smaller man day, it is accurate and adjustment of oscillating frequency is attained.
[0021]The spurious radiation from the print pattern of said this 2nd inductance can be reduced by using said 2nd inductance as a print pattern, and using an opposite side as an earth pattern.
[0022]
[Example]It explains referring to drawings for the example of this invention below. Drawing 1 is a block diagram showing the BS tuner in one example of this invention.
[0023]BS tuner 14 consists of the down converter part 12 and the demodulation section 13 in drawing 1. Said down converter part 12 consists of the mixer 3 into which RF amplifier 2 connected to the input terminal 1, and this RF amplifier 2 and 1st oscillator 8 are inputted, and IF amplifier 4 connected to the output of this mixer 3.
[0024]The phase comparator 5 by which said demodulation section 13 was connected to said IF amplifier 4, The loop amplifier 6 connected to this phase comparator 5, and the video amplifier 7 connected to this loop amplifier 6, It consists of the low pass filter (henceforth LPF) 10

connected to the output of said loop amplifier 6, and said 2nd oscillator 9 connected to the output of this LPF10, and the output of this 2nd oscillator 9 is inputted into said phase comparator 5.
[0025]The output of said video amplifier 7 is connected to the output terminal 11. Next, operation is explained. Through said input terminal 1, the input signal from BS antenna is amplified with said RF amplifier 2, and is behind inputted into said mixer 3.
[0026]Frequency conversion of the signal inputted into this mixer 3 is carried out with said 1st oscillator 8, After being amplified with said IF amplifier 4, it gets over by said demodulation section 13 which comprises said phase comparator 5, said loop amplifier 6, said LPF10, and said 2nd oscillator 9, and a demodulation component is amplified with said video amplifier 7, and is outputted from said output terminal 11.
[0027]Drawing 2 is a detail view of said 2nd oscillator 9. Drawing 2 shows the tuned circuit 72 which determines the balanced type oscillating circuit 71 and oscillating frequency.
[0028]The introduction balance type oscillating circuit 71 is explained. The transistors 53 and 54 constitute a differential amplifying circuit, and the emitter is connected to the grounding terminal 63 through both the constant current sources 60.
[0029]The collector of said transistor 54 is connected to the 1st output terminal 62 via the capacitor 55, and this 1st output terminal 62 is connected to the base of said transistor 53 via the capacitor 56.
[0030]The collector of this transistor 53 is connected to the 2nd output terminal 64 via the capacitor 58, and this 2nd output terminal 64 is connected to the base of said transistor 54 via the capacitor 57.
[0031]The voltage applied to the voltage supplying terminal 61 is supplied to said transistors 53 and 54 via the resistance 51 and 52, respectively, and the output of the amplifying circuit 59 of loop amplifier is connected to the voltage control terminal 65.
[0032]Next, said tuned circuit 72 is explained. Said 1st output terminal 62 and the coil 66 for adjustment provided between earth patterns, It constitutes from a series circuit of the varicap diodes 67 and 69 which connected cathodes between said 2nd output terminal 64, the pattern 70 for alignment provided between earth patterns, and said 1st output terminal 62 and said 2nd output terminal 64.
[0033]The resistance 68 is formed between the node of these two varicap diodes 67 and 69, and said voltage control terminal 65.
[0034]By the above composition, a balanced type oscillating circuit is constructed with said transistors 53 and 54, Positive feedback is applied by said capacitors 55 and 56, and 57 and 58, and oscillating frequency is mainly determined with said coil 66 for adjustment in said tuned circuit 72, said pattern 70 for alignment, and said two varicap diodes 67 and 69.
[0035]Drawing 3 is an important section perspective view of the 2nd oscillator by this invention shown in drawing 2. IC101 which includes the balanced type oscillating circuit 71 on the printed circuit board 107 in drawing 3, The coil 66 for adjustment which consists of a winding coil connected between the 1st output terminal 62 of this IC101, and the 1st earth pattern 111, The series circuit of the varicap diodes 67 and 69 which connected cathodes between the pattern 70 for alignment which consists of a print pattern connected between the 2nd output terminal 64 and the 2nd earth pattern 112, and said 1st output terminal 62 and said 2nd output terminal 64 is connected.
[0036]The resistance 68 is formed between the node 113 with these two varicap diodes 67 and 69, and the voltage control terminal 65.
[0037]Next, drawing 4 explains signs that oscillating frequency is adjusted with said coil 66 for

adjustment. Drawing 4 (a) looks at drawing 3 from the upper surface A of covering, and drawing 4 (b) looks at drawing 3 from the side B.
[0038]In drawing 4 (a) and drawing 4 (b), in the earth pattern 257 of the printed circuit board 107, it is connected by soldering, and the metallic frame 255 is covered with the metallic covers 254 and 258, and, as for the upper surface, establishes the covering hole 251 for coil adjustment in this metallic cover 254.
[0039]Making [and] it the direction and said pattern 253 for alignment of a roller of said coil 66 for adjustment located almost in parallel at this time, the interval Q from said coil 66 for adjustment to the outside of said pattern 70 for alignment makes it less than it whether to be equivalent to the outer diameter P of said coil 66 for adjustment.
[0040]However, it thinks as what the float to said printed circuit board 107 of said coil 66 for adjustment does not have at this time.
[0041]By this mutual-inductance M generated between said coil 107 for adjustment, and said pattern 70 for alignment, adjustment of oscillating frequency is attained without changing **M every as a changed part of a mutual inductance, and losing most balance of a tuned circuit as a result by leaning said coil 107 for adjustment to the direction of said pattern 70 for alignment.
[0042]Drawing 4 (c) and (d) shows the state after leaning and adjusting the coil for adjustment to the direction of the pattern for alignment of a lot in drawing 4 (a) and (b).
[0043]The case where the interval Q from said coil 66 for adjustment to the outside of said pattern 70 for alignment is set as the abbreviation 1/2 of the outer diameter P of said coil 66 for adjustment is explained using drawing 4 (a), (b), (c), and (d).
[0044]By this setting out, mutual-inductance M between said coil 66 for adjustment and said pattern 70 for alignment is made [two] in about 1/to a conventional example, and change **M of a mutual inductance is made to one half to a conventional example. The variable range of oscillating frequency with said coil 66 for adjustment at that time is about 18 MHz, and is enough to 10 MHz of an actually required variable range.
[0045]That is, the sensitivity to change of frequency with the coil for adjustment can be set [two] up in about 1/of a conventional example, and adjustment with the sufficient accuracy of oscillating frequency is attained.
[0046]The coil which seems to be clearer than drawing 4 (a) from said covering hole 251 for adjustment turns into only the one coil 66 for adjustment, Since this coil 66 for adjustment is leaned and adjusted, adjustment is easy, this covering hole for adjustment can be further made small, and spurious radiation and diving can be improved.
[0047]Drawing 5 (a) and (b) shows the case where an earth pattern is provided in the opposite side of the print pattern which constitutes the inductance of a tuned circuit, from drawing 4 (a) and (b).
[0048]In drawing 5 (a) and (b), in the earth pattern 307 of the printed circuit board 107, it is connected by soldering, and the metallic frame 255 is covered with the metallic covers 254 and 258, and, as for said metallic frame 255, establishes the covering hole 251 for coil adjustment in this metallic cover 254.
[0049]To said printed circuit board 107, the coil 66 for adjustment and the pattern 70 for alignment are set at the same physical relationship as drawing 4 (a) and (b), said earth pattern 307 is put on the opposite side of this pattern 70 for alignment, and it has composition of a microstrip line.
[0050]Thereby, the level of the spurious radiation emitted from the inductance by said pattern 70 for alignment is reduced.

[0051]Drawing 6 is an important section perspective view of the 2nd oscillator by this invention shown in drawing 2.
The case where the shape of the print pattern which constitutes the pattern for alignment differs is shown.

[0052]IC101 which includes a balanced type oscillating circuit on the printed circuit board 357 in drawing 6, The coil 66 for adjustment connected between the 1st output terminal 62 of this IC101, and the earth pattern 111, The varicap diodes 67 and 69 which carried out the series connection of the cathodes between the pattern 356 for alignment connected between the 2nd output terminal 64 and the earth pattern 112, and said 1st output terminal 62 and said 2nd terminal 64 are arranged.
[0053]The resistance 68 is formed between the node 113 with these two varicap diodes 67 and 69, and the voltage control terminal 65.
[0054]Drawing 7 (a) and (b) explains signs that oscillating frequency is adjusted with said coil 66 for adjustment.
[0055]Drawing 7 (a) looks at drawing 6 from the upper surface A of covering, and drawing 7 (b) looks at drawing 6 from the side B.
[0056]In drawing 7 (a) and (b), in the earth pattern 407 of the printed circuit board 357, it is connected by soldering and the metallic frame 255 shows the case where said earth pattern 407 is put on the opposite side of the substrate of the pattern 356 for alignment which consists of the 408,409,410th grade.
[0057]Said metallic frame 255 is covered with the metallic covers 258 and 254, and establishes the covering hole 251 for coil adjustment in this metallic cover 254.
[0058]Said horseshoe-shaped pattern 356 for alignment which makes said coil 66 for alignment counter, and becomes from 408-410 at this time is formed.
[0059]The furthest pattern part 410 for alignment is specifically located from said coil 66 for adjustment almost in parallel to the direction of the winding of the coil 66 for adjustment, The pattern part 409 for alignment is connected to this pattern part 410 for alignment in the direction of said coil 66 for adjustment almost right-angled at one side of said pattern part 410 for alignment, The pattern part 408 for alignment is connected to the other end of said pattern part 410 for alignment in the direction of said coil 66 for adjustment almost right-angled at said pattern part 410 for alignment.
[0060]At this time, the relation with the size R from the outer diameter P and said coil 66 for adjustment of a winding portion of said coil 66 for adjustment to the outside of said pattern part 410 for alignment is mostly made into P>=R, and is further made mostly into P<=S about length [of said pattern part 410 for alignment] S.
[0061]Thereby, said pattern part 408 for alignment and all of 409 and 410 will have a mutual inductance between said coils 66 for adjustment, and the adjustable range and adjustment accuracy of frequency at the time of coil adjustment can be chosen by this setting out of R and S.
[0062]Drawing 8 and drawing 9 show the case where the shape of the pattern for alignment which comprises 408,409,410 of drawing 7 (a) which is one example of this invention differs.
[0063]In drawing 8, the covering hole 251 for adjustment was established in the metallic cover 254, and the zigzag type pattern 454 for alignment which consists of the coil 66 for adjustment which consists of a winding coil, and a print pattern is formed.
[0064]At this time, it is made into less than it whether for the size V from said coil 66 for adjustment to the outside of said pattern 454 for alignment to be almost the same to the outer

diameter P of said coil 66 for adjustment.
[0065]The mutual inductance between said coil 66 for adjustment and said pattern 454 for alignment can take by this more greatly than the mutual inductance in drawing 7 (a) which is one example of this invention, and the adjustable range and adjustment accuracy of frequency at the time of coil adjustment can be chosen.
[0066]In drawing 9, the covering hole 251 for adjustment is established in the metallic cover 254, the pattern 454 for alignment which consists of a print pattern made spiral with the coil 66 for adjustment which consists of a winding coil is formed, and the central part is connected to the earth pattern 475.
[0067]At this time, it is made into less than it whether for the size W from said coil 66 for adjustment to the outside of said pattern 474 for alignment to be almost the same to the outer diameter P of said coil 66 for adjustment.
[0068]The mutual inductance between said coil 66 for adjustment and said pattern 474 for alignment can take by this more greatly than the mutual inductance in drawing 7 (a) which is one example of this invention, and the adjustable range and adjustment accuracy of frequency at the time of coil adjustment can be chosen.
[0069]
[Effect of the Invention]As mentioned above, while according to the tuned circuit of the oscillator of this invention using the 1st inductance as the coil for adjustment which consists of a winding coil and forming the 2nd inductance by the pattern for alignment which consists of microstrip lines, It is made to counter so that it may have a mutual inductance between said 1st inductance and said 2nd inductance, and arranges, and said coil for adjustment is leaned and adjusted to the direction of said inductance.
[0070]Without becoming one piece and caring about the coil of another side like before, since it can adjust, the coil for adjustment which this looked at from the covering hole can make the covering hole for adjustment small, and an effective design is possible for it to disturbance by spurious radiation or diving.
[0071]By composition of the tuned circuit which consists of a pattern for alignment which consists of microstrip lines, and a coil for adjustment. Disclosure of the oscillation ingredient from a tuned circuit can be substantially reduced by being able to set up the variation of the mutual inductance optimal at the time of adjustment, and attaining adjustment with the sufficient accuracy of oscillating frequency, and using a microstrip line for a tuned circuit.
[0072]As mentioned above, a high frequency device with the balanced type oscillator which is low cost and was excellent can be provided by adopting this invention.

TECHNICAL FIELD

[Industrial Application]This invention relates to a balanced type oscillator and the high frequency device which used it.

PRIOR ART

[Description of the Prior Art]The conventional balanced type oscillator is explained below.
[0003]The conventional oscillator was constituted as shown in drawing 10. Namely, IC501 which includes a balanced type oscillating circuit on the printed circuit board 507, The 1st coil 505 for adjustment provided between the 1st output terminal 508 of this IC501, and the 1st earth

pattern 511, The 2nd coil 506 for adjustment provided between the 2nd output terminal 510 of said IC501, and the 2nd earth pattern 512, The series circuit with the two varicap diodes 503 and 504 which connected cathodes between said 1st output terminal 508 and the 2nd output terminal 510 was arranged.
[0004]The resistance 502 was formed between the node 513 of these two varicap diodes 503 and 504, and the voltage control terminal 509 of said IC501.
[0005]And adjustment of this oscillating frequency was performed by adjusting the interval of said 1st coil 505 for adjustment, and said 2nd coil 506 for adjustment, and changing a mutual inductance.
[0006]The situation of adjustment with the coil for adjustment in the conventional oscillator is explained to drawing 11 (a), (b), (c), and (d).
[0007]At drawing 11 (a), the state where drawing 10 was seen from the upper surface A is shown, and drawing 11 (b) shows the state where drawing 10 was seen from the side B.
[0008]The earth pattern 557 of the printed circuit board 507 is soldered to the metallic frame 555 by drawing 11 (a) and (b), Forming the 1st coil 505 for adjustment, and the 2nd coil 506 for adjustment in said substrate 507, said metallic frame 555 was covered with the coverings 554 and 558, and has established the covering hole 551 for coil adjustment in this covering 554.
[0009]While said 1st coil 505 for adjustment and said 2nd coil 506 for adjustment make a roller a uniform direction mostly and arrange it at this time, The outer diameter P of this 1st alignment coil 505 and the 2nd coil 506 for adjustment presupposes that it is the same in abbreviation, sets the interval U of this 1st alignment coil 505 and the 2nd coil 506 for adjustment to two in about 1/of the outer diameter P of said 1st coil 505 for adjustment, and is giving mutual-inductance M mutually.
[0010]Drawing 11 (c) and (d) shows the state after adjustment with these two coils for adjustment.
[0011]If the 1st coil 505 for adjustment is leaned to the direction of the 2nd coil 506 for adjustment and both interval is adjusted in drawing 11 (c) and (d), Oscillating frequency can be adjusted, while the mutual inductance of both said 1st coil 505 for adjustment and said 2nd coil 506 for adjustment can fluctuate only **M and maintains the balance of an oscillator.
[0012]The variable range of oscillating frequency with said 1st coil 505 for adjustment is about 35 MHz, and to 10 MHz of an actually required variable range, although it is sufficient value, specifically, Mutual mutual-inductance M was large, change **M of the mutual inductance at the time of coil adjustment became large, the variation of frequency became large as a result, and fine adjustment of oscillating frequency was difficult.
[0013]Although it is possible to extend the interval U of said 1st coil 505 for adjustment, and said 2nd coil 506 for adjustment in drawing 11 (b) as one of the improving method of this, For example, in order to set the variable range of oscillating frequency with said 1st coil 505 for adjustment to two in about 1/from conventional 35 MHz, The interval U of said 1st coil 505 for adjustment and said 2nd coil 506 for adjustment must be extended from 0.5 time from an experiment 1.25 times and about 2.5 times to the outer diameter P of said 1st coil 505 for adjustment.
[0014]That is, a space will be occupied more greatly on a printed circuit board than a conventional example. By radiation of the oscillation ingredient from the coil for adjustment, the sensitivity of a BS tuner is lowered, for example, or noise volume was enlarged and performance was degraded.
[0015]When adjusting one coil for adjustment with a regulating rod, it hits the coil for

adjustment of another side, It is necessary to enlarge the covering hole 551 for said coil adjustment for adjusting these two coils 505,506 for adjustment more than twice [further / about], and it is influenced to the exterior of a BS tuner by the spurious radiation and diving by this covering hole 551, or gives.

EFFECT OF THE INVENTION

[Effect of the Invention]As mentioned above, while according to the tuned circuit of the oscillator of this invention using the 1st inductance as the coil for adjustment which consists of a winding coil and forming the 2nd inductance by the pattern for alignment which consists of microstrip lines, It is made to counter so that it may have a mutual inductance between said 1st inductance and said 2nd inductance, and arranges, and said coil for adjustment is leaned and adjusted to the direction of said inductance.
[0070]Without becoming one piece and caring about the coil of another side like before, since it can adjust, the coil for adjustment which this looked at from the covering hole can make the covering hole for adjustment small, and an effective design is possible for it to disturbance by spurious radiation or diving.
[0071]By composition of the tuned circuit which consists of a pattern for alignment which consists of microstrip lines, and a coil for adjustment. Disclosure of the oscillation ingredient from a tuned circuit can be substantially reduced by being able to set up the variation of the mutual inductance optimal at the time of adjustment, and attaining adjustment with the sufficient accuracy of oscillating frequency, and using a microstrip line for a tuned circuit.
[0072]As mentioned above, a high frequency device with the balanced type oscillator which is low cost and was excellent can be provided by adopting this invention.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]In such conventional composition, by radiation of the oscillation ingredient from the coil 505,506 for adjustment, the sensitivity of a BS tuner is lowered, for example, or noise volume was enlarged and performance was degraded.
[0017]Since a regulating rod is put into the covering hole 551 for coil adjustment, a mutual inductance is changed by the interval of the two coils 505,506 for adjustment at the time of adjustment and oscillating frequency is adjusted, change the coil for adjustment of an adjusting side, or, Since it was hard to double the variation to the oscillating frequency at the time of coil adjustment with large predetermined oscillating frequency again, the man day had started.
[0018]Therefore, this covering hole 551 was the issue which it must be large for adjustment of a coil, must be made small in order for disturbance by spurious radiation and diving to be generating in one side, and must be solved. Then, adjustment accuracy of this invention is high and it aims at moreover providing what has few spurious radiation and diving.

MEANS

[Means for Solving the Problem]In order to attain this purpose, while using the 1st inductance as a coil for adjustment which consists of a winding coil in a tuned circuit of an oscillator of this invention and forming the 2nd IDANKU wardrobe by a pattern for alignment which consists of

print patterns, It is made to counter so that it may have a mutual inductance between said 1st inductance and said 2nd inductance, and arranges.

OPERATION

[Function]Since the 1st inductance is used as a winding coil and the 2nd inductance is formed with the print pattern from this composition, Adjustment of oscillating frequency is possible for the coil for adjustment seen from the covering hole, without becoming one piece and caring about the coil for adjustment of another side like before, and since variation to the oscillating frequency at the time of coil adjustment can be made small, by a smaller man day, it is accurate and adjustment of oscillating frequency is attained.
[0021]The spurious radiation from the print pattern of said this 2nd inductance can be reduced by using said 2nd inductance as a print pattern, and using an opposite side as an earth pattern.

EXAMPLE

[Example]It explains referring to drawings for the example of this invention below. Drawing 1 is a block diagram showing the BS tuner in one example of this invention.
[0023]BS tuner 14 consists of the down converter part 12 and the demodulation section 13 in drawing 1. Said down converter part 12 consists of the mixer 3 into which RF amplifier 2 connected to the input terminal 1, and this RF amplifier 2 and 1st oscillator 8 are inputted, and IF amplifier 4 connected to the output of this mixer 3.
[0024]The phase comparator 5 by which said demodulation section 13 was connected to said IF amplifier 4, The loop amplifier 6 connected to this phase comparator 5, and the video amplifier 7 connected to this loop amplifier 6, It consists of the low pass filter (henceforth LPF) 10 connected to the output of said loop amplifier 6, and said 2nd oscillator 9 connected to the output of this LPF10, and the output of this 2nd oscillator 9 is inputted into said phase comparator 5.
[0025]The output of said video amplifier 7 is connected to the output terminal 11. Next, operation is explained. Through said input terminal 1, the input signal from BS antenna is amplified with said RF amplifier 2, and is behind inputted into said mixer 3.
[0026]Frequency conversion of the signal inputted into this mixer 3 is carried out with said 1st oscillator 8, After being amplified with said IF amplifier 4, it gets over by said demodulation section 13 which comprises said phase comparator 5, said loop amplifier 6, said LPF10, and said 2nd oscillator 9, and a demodulation component is amplified with said video amplifier 7, and is outputted from said output terminal 11.
[0027]Drawing 2 is a detail view of said 2nd oscillator 9. Drawing 2 shows the tuned circuit 72 which determines the balanced type oscillating circuit 71 and oscillating frequency.
[0028]The introduction balance type oscillating circuit 71 is explained. The transistors 53 and 54 constitute a differential amplifying circuit, and the emitter is connected to the grounding terminal 63 through both the constant current sources 60.
[0029]The collector of said transistor 54 is connected to the 1st output terminal 62 via the capacitor 55, and this 1st output terminal 62 is connected to the base of said transistor 53 via the capacitor 56.
[0030]The collector of this transistor 53 is connected to the 2nd output terminal 64 via the capacitor 58, and this 2nd output terminal 64 is connected to the base of said transistor 54 via the capacitor 57.

[0031]The voltage applied to the voltage supplying terminal 61 is supplied to said transistors 53 and 54 via the resistance 51 and 52, respectively, and the output of the amplifying circuit 59 of loop amplifier is connected to the voltage control terminal 65.
[0032]Next, said tuned circuit 72 is explained. Said 1st output terminal 62 and the coil 66 for adjustment provided between earth patterns, It constitutes from a series circuit of the varicap diodes 67 and 69 which connected cathodes between said 2nd output terminal 64, the pattern 70 for alignment provided between earth patterns, and said 1st output terminal 62 and said 2nd output terminal 64.
[0033]The resistance 68 is formed between the node of these two varicap diodes 67 and 69, and said voltage control terminal 65.
[0034]By the above composition, a balanced type oscillating circuit is constructed with said transistors 53 and 54, Positive feedback is applied by said capacitors 55 and 56, and 57 and 58, and oscillating frequency is mainly determined with said coil 66 for adjustment in said tuned circuit 72, said pattern 70 for alignment, and said two varicap diodes 67 and 69.
[0035]Drawing 3 is an important section perspective view of the 2nd oscillator by this invention shown in drawing 2. IC101 which includes the balanced type oscillating circuit 71 on the printed circuit board 107 in drawing 3, The coil 66 for adjustment which consists of a winding coil connected between the 1st output terminal 62 of this IC101, and the 1st earth pattern 111, The series circuit of the varicap diodes 67 and 69 which connected cathodes between the pattern 70 for alignment which consists of a print pattern connected between the 2nd output terminal 64 and the 2nd earth pattern 112, and said 1st output terminal 62 and said 2nd output terminal 64 is connected.
[0036]The resistance 68 is formed between the node 113 with these two varicap diodes 67 and 69, and the voltage control terminal 65.
[0037]Next, drawing 4 explains signs that oscillating frequency is adjusted with said coil 66 for adjustment. Drawing 4 (a) looks at drawing 3 from the upper surface A of covering, and drawing 4 (b) looks at drawing 3 from the side B.
[0038]In drawing 4 (a) and drawing 4 (b), in the earth pattern 257 of the printed circuit board 107, it is connected by soldering, and the metallic frame 255 is covered with the metallic covers 254 and 258, and, as for the upper surface, establishes the covering hole 251 for coil adjustment in this metallic cover 254.
[0039]Making [and] it the direction and said pattern 253 for alignment of a roller of said coil 66 for adjustment located almost in parallel at this time, the interval Q from said coil 66 for adjustment to the outside of said pattern 70 for alignment makes it less than it whether to be equivalent to the outer diameter P of said coil 66 for adjustment.
[0040]However, it thinks as what the float to said printed circuit board 107 of said coil 66 for adjustment does not have at this time.
[0041]By this mutual-inductance M generated between said coil 107 for adjustment, and said pattern 70 for alignment, adjustment of oscillating frequency is attained without changing **M every as a changed part of a mutual inductance, and losing most balance of a tuned circuit as a result by leaning said coil 107 for adjustment to the direction of said pattern 70 for alignment.
[0042]Drawing 4 (c) and (d) shows the state after leaning and adjusting the coil for adjustment to the direction of the pattern for alignment of a lot in drawing 4 (a) and (b).
[0043]The case where the interval Q from said coil 66 for adjustment to the outside of said pattern 70 for alignment is set as the abbreviation 1/2 of the outer diameter P of said coil 66 for adjustment is explained using drawing 4 (a), (b), (c), and (d).

[0044]By this setting out, mutual-inductance M between said coil 66 for adjustment and said pattern 70 for alignment is made [two] in about 1/to a conventional example, and change **M of a mutual inductance is made to one half to a conventional example. The variable range of oscillating frequency with said coil 66 for adjustment at that time is about 18 MHz, and is enough to 10 MHz of an actually required variable range.
[0045]That is, the sensitivity to change of frequency with the coil for adjustment can be set [two] up in about 1/of a conventional example, and adjustment with the sufficient accuracy of oscillating frequency is attained.
[0046]The coil which seems to be clearer than drawing 4 (a) from said covering hole 251 for adjustment turns into only the one coil 66 for adjustment, Since this coil 66 for adjustment is leaned and adjusted, adjustment is easy, this covering hole for adjustment can be further made small, and spurious radiation and diving can be improved.
[0047]Drawing 5 (a) and (b) shows the case where an earth pattern is provided in the opposite side of the print pattern which constitutes the inductance of a tuned circuit, from drawing 4 (a) and (b).
[0048]In drawing 5 (a) and (b), in the earth pattern 307 of the printed circuit board 107, it is connected by soldering, and the metallic frame 255 is covered with the metallic covers 254 and 258, and, as for said metallic frame 255, establishes the covering hole 251 for coil adjustment in this metallic cover 254.
[0049]To said printed circuit board 107, the coil 66 for adjustment and the pattern 70 for alignment are set at the same physical relationship as drawing 4 (a) and (b), said earth pattern 307 is put on the opposite side of this pattern 70 for alignment, and it has composition of a microstrip line.
[0050]Thereby, the level of the spurious radiation emitted from the inductance by said pattern 70 for alignment is reduced.
[0051]Drawing 6 is an important section perspective view of the 2nd oscillator by this invention shown in drawing 2.
The case where the shape of the print pattern which constitutes the pattern for alignment differs is shown.

[0052]IC101 which includes a balanced type oscillating circuit on the printed circuit board 357 in drawing 6, The coil 66 for adjustment connected between the 1st output terminal 62 of this IC101, and the earth pattern 111, The varicap diodes 67 and 69 which carried out the series connection of the cathodes between the pattern 356 for alignment connected between the 2nd output terminal 64 and the earth pattern 112, and said 1st output terminal 62 and said 2nd terminal 64 are arranged.
[0053]The resistance 68 is formed between the node 113 with these two varicap diodes 67 and 69, and the voltage control terminal 65.
[0054]Drawing 7 (a) and (b) explains signs that oscillating frequency is adjusted with said coil 66 for adjustment.
[0055]Drawing 7 (a) looks at drawing 6 from the upper surface A of covering, and drawing 7 (b) looks at drawing 6 from the side B.
[0056]In drawing 7 (a) and (b), in the earth pattern 407 of the printed circuit board 357, it is connected by soldering and the metallic frame 255 shows the case where said earth pattern 407 is put on the opposite side of the substrate of the pattern 356 for alignment which consists of the 408,409,410th grade.

[0057]Said metallic frame 255 is covered with the metallic covers 258 and 254, and establishes the covering hole 251 for coil adjustment in this metallic cover 254.
[0058]Said horseshoe-shaped pattern 356 for alignment which makes said coil 66 for alignment counter, and becomes from 408-410 at this time is formed.
[0059]The furthest pattern part 410 for alignment is specifically located from said coil 66 for adjustment almost in parallel to the direction of the winding of the coil 66 for adjustment, The pattern part 409 for alignment is connected to this pattern part 410 for alignment in the direction of said coil 66 for adjustment almost right-angled at one side of said pattern part 410 for alignment, The pattern part 408 for alignment is connected to the other end of said pattern part 410 for alignment in the direction of said coil 66 for adjustment almost right-angled at said pattern part 410 for alignment.
[0060]At this time, the relation with the size R from the outer diameter P and said coil 66 for adjustment of a winding portion of said coil 66 for adjustment to the outside of said pattern part 410 for alignment is mostly made into P>=R, and is further made mostly into P<=S about length [of said pattern part 410 for alignment] S.
[0061]Thereby, said pattern part 408 for alignment and all of 409 and 410 will have a mutual inductance between said coils 66 for adjustment, and the adjustable range and adjustment accuracy of frequency at the time of coil adjustment can be chosen by this setting out of R and S.
[0062]Drawing 8 and drawing 9 show the case where the shape of the pattern for alignment which comprises 408,409,410 of drawing 7 (a) which is one example of this invention differs.
[0063]In drawing 8, the covering hole 251 for adjustment was established in the metallic cover 254, and the zigzag type pattern 454 for alignment which consists of the coil 66 for adjustment which consists of a winding coil, and a print pattern is formed.
[0064]At this time, it is made into less than it whether for the size V from said coil 66 for adjustment to the outside of said pattern 454 for alignment to be almost the same to the outer diameter P of said coil 66 for adjustment.
[0065]The mutual inductance between said coil 66 for adjustment and said pattern 454 for alignment can take by this more greatly than the mutual inductance in drawing 7 (a) which is one example of this invention, and the adjustable range and adjustment accuracy of frequency at the time of coil adjustment can be chosen.
[0066]In drawing 9, the covering hole 251 for adjustment is established in the metallic cover 254, the pattern 454 for alignment which consists of a print pattern made spiral with the coil 66 for adjustment which consists of a winding coil is formed, and the central part is connected to the earth pattern 475.
[0067]At this time, it is made into less than it whether for the size W from said coil 66 for adjustment to the outside of said pattern 474 for alignment to be almost the same to the outer diameter P of said coil 66 for adjustment.
[0068]The mutual inductance between said coil 66 for adjustment and said pattern 474 for alignment can take by this more greatly than the mutual inductance in drawing 7 (a) which is one example of this invention, and the adjustable range and adjustment accuracy of frequency at the time of coil adjustment can be chosen.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The block diagram showing the BS tuner by one example of this invention

[Drawing 2]The circuit diagram of the 2nd oscillator of the BS tuner
[Drawing 3]The important section perspective view of the 2nd oscillator of the BS tuner
[Drawing 4](a) is the plan which looked at the state before adjustment with the coil of drawing 3 from the upper surface A of covering of drawing 3.
(b) is the sectional view which looked at the state before adjustment with the coil of drawing 3 from the side B of drawing 3.
(c) is the plan which looked at the state after adjustment with the coil of drawing 3 from the upper surface A of covering of drawing 3.
(d) is the sectional view which looked at the state after adjustment with the coil of drawing 3 from the side B of drawing 3.
[Drawing 5](a) is a plan of other examples corresponding to drawing 4 (a).
(b) is a sectional view of other examples corresponding to drawing 4 (b).
[Drawing 6]The important section perspective view of the 2nd oscillator of a BS tuner
[Drawing 7](a) is the plan which looked at the state before adjustment with the coil of drawing 6 from the upper surface A of covering.
(b) is the sectional view which looked at the state before adjustment with the coil of drawing 6 from the side B of covering.
[Drawing 8]The plan of other examples of the pattern for alignment
[Drawing 9]The plan of other examples of the pattern for alignment
[Drawing 10]The important section perspective view of the 2nd oscillator of the conventional BS tuner
[Drawing 11](a) is the plan which looked at the state before adjustment with the coil of drawing 10 from the upper surface A of covering.
(b) is the sectional view which looked at the state before adjustment with the coil of drawing 10 from the side B of covering.
(c) is a plan showing the state after adjustment with the coil of drawing 11 (a).
(d) is a sectional view showing the state after adjustment with the coil of drawing 11 (b).
[Description of Notations]
1 Input terminal
9 The 2nd oscillating circuit
11 Output terminal
12 Down converter part
13 Demodulation section
62 The 1st output terminal
64 The 2nd output terminal
66 The coil for adjustment
67 Varicap diode
69 Varicap diode
70 The pattern for alignment
71 Balanced type oscillating circuit
72 Tuned circuit

[Translation done.]

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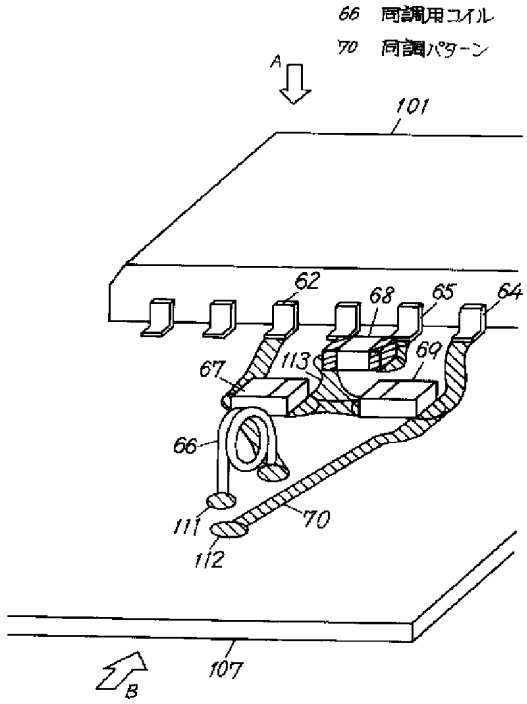
(54)【発明の名称】　バランス型発振器とそれを用いた高周波装置

(57)【要約】

【目的】　バランス型発振器の同調回路において、コイルによる周波数の調整精度が高く、しかも不要輻射や飛び込みによる妨害を低減することを目的とするものである。

【構成】　バランス型発振器の同調回路において、第１のインダクタンスを同調用コイル６６とし、第２のインダクタンスを同調パターン７０とし、第１のインダクタンスと第２のインダクタンスとの間に相互インダクタンスを有するように対向させて配置した構成とする。



【特許請求の範囲】
【請求項１】　バランス型発振回路と、このバランス型発振回路の出力側に設けた同調回路とを備え、前記同調回路は、前記バランス型発振回路の第１の出力端子と第１のアース間とに接続された巻線コイルよりなる調整用コイルと、前記バランス型発振回路の第２の出力端子と第２のアース間との間に接続されたプリントパターンからなる同調用パターンと、前記第１の出力端子と前記第２の出力端子との間に接続されたキャパシタンスとを有し、前記調整用コイルと前記同調用パターンとの間に相互インダクタンスを持たせ、前記調整用コイルにより前記相互インダクタンスを変えて発振周波数の調整を可能としたバランス型発振器。
【請求項２】　プリント基板の片面にプリントパターンからなる同調用パターンを形成するとともに、その反対面側にはアースパターンを配した請求項１記載のバランス型発振器。
【請求項３】　入力端子と、この入力端子に接続されたダウンコンバータ部と、このダウンコンバータ部に接続された復調部と、この復調部に接続された出力端子とを備え、前記復調部内に請求項１記載のバランス型発振器を設けた高周波装置。
【請求項４】　入力端子と、この入力端子に接続されたダウンコンバータ部と、このダウンコンバータ部に接続された復調部と、この復調部に接続された出力端子とを備え、前記復調部内に請求項２記載のバランス型発振器を設けた高周波装置。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明はバランス型発振器とそれを用いた高周波装置に関するものである。
【０００２】
【従来の技術】以下に従来のバランス型発振器について説明する。
【０００３】従来の発振器は、図１０に示すように構成されていた。すなわち、プリント基板５０７の上に、バランス型発振回路を含むＩＣ５０１と、このＩＣ５０１の第１の出力端子５０８と第１のアースパターン５１１との間に設けられた第１の調整用コイル５０５と、前記ＩＣ５０１の第２の出力端子５１０と第２のアースパターン５１２との間に設けた第２の調整用コイル５０６と、前記第１の出力端子５０８と第２の出力端子５１０との間にカソード同士を接続した２個のバリキャップダイオード５０３と５０４との直列回路とを配置していた。
【０００４】また、この２個のバリキャップダイオード５０３と５０４の接続点５１３と前記ＩＣ５０１の電圧制御端子５０９との間には抵抗５０２を設けていた。
【０００５】そして、この発振周波数の調整は前記第１の調整用コイル５０５と前記第２の調整用コイル５０６の間隔を調整して相互インダクタンスを可変することにより行っていた。
【０００６】図１１（ａ），（ｂ），（ｃ），（ｄ）に従来の発振器での調整用コイルによる調整の様子を説明する。
【０００７】図１１（ａ）では、図１０を上面Ａからみた状態を示し、図１１（ｂ）では、図１０を側面Ｂからみた状態を示す。
【０００８】図１１（ａ）および（ｂ）では、プリント基板５０７のアースパターン５５７は金属フレーム５５５に半田付けされ、前記基板５０７には第１の調整用コイル５０５と第２の調整用コイル５０６を設け、前記金属フレーム５５５はカバー５５４と５５８とで覆われ、このカバー５５４にはコイル調整用のカバー穴５５１を設けている。
【０００９】この時、前記第１の調整用コイル５０５と前記第２の調整用コイル５０６とは巻軸をほぼ同一方向にして配置するとともに、この第１の調整コイル５０５と第２の調整用コイル５０６の外径Ｐは略同一とし、この第１の調整コイル５０５と第２の調整用コイル５０６の間隔Ｕを前記第１の調整用コイル５０５の外径Ｐの約１／２とし互いに相互インダクタンスＭをもたせている。
【００１０】図１１（ｃ）および（ｄ）では、この２つの調整用コイルによる調整後の状態を示す。
【００１１】図１１（ｃ）および（ｄ）において、第１の調整用コイル５０５を第２の調整用コイル５０６の方へ傾けて両者の間隔を調整すると、前記第１の調整用コイル５０５と前記第２の調整用コイル５０６の両者の相互インダクタンスが△Ｍだけ増減でき、発振器のバランスを保ちながら発振周波数の調整を行うことができる。
【００１２】具体的には、前記第１の調整用コイル５０５による発振周波数の可変範囲は約３５ＭＨｚで、実際に必要な可変範囲の１０ＭＨｚに対しては十分な値であるが、互いの相互インダクタンスＭが大きく、コイル調整時の相互インダクタンスの変化△Ｍが大きくなってしまい、結果として周波数の変化量が大きくなり発振周波数の微調整が困難であった。
【００１３】この改善法のひとつとして、図１１（ｂ）において前記第１の調整用コイル５０５と前記第２の調整用コイル５０６の間隔Ｕを広げることが考えられるが、例えば前記第１の調整用コイル５０５による発振周波数の可変範囲を従来の３５ＭＨｚから約１／２とするには、実験より前記第１の調整用コイル５０５と前記第２の調整用コイル５０６の間隔Ｕを、前記第１の調整用コイル５０５の外径Ｐに対して０．５倍から１．２５倍と約２．５倍に広げなければならない。
【００１４】つまり、従来例よりプリント基板上で大きくスペースを占有してしまう。また、調整用コイルからの発振成分の輻射により、例えばＢＳチューナの感度を

下げたりノイズ量を大きくして性能を劣化させていた。
【００１５】さらに、調整棒によって一方の調整用コイルを調整する時に他方の調整用コイルにあたり、この２つの調整用コイル５０５，５０６を調整するための前記コイル調整用のカバー穴５５１をさらに約２倍以上大きくする必要があり、このカバー穴５５１による不要輻射および飛び込みによりＢＳチューナの外部に対し影響を受けたり与えたりする。
【００１６】
【発明が解決しようとする課題】このような従来の構成では、調整用コイル５０５，５０６からの発振成分の輻射により、例えばＢＳチューナの感度を下げたりノイズ量を大きくして性能を劣化させていた。
【００１７】また、調整時には、コイル調整用のカバー穴５５１に調整棒を入れ２つの調整用コイル５０５，５０６の間隔により相互インダクタンスを変えて発振周波数を調整するので被調整側の調整用コイルを変形したり、またコイル調整時の発振周波数への変化量が大きく所定の発振周波数に合わせにくいため工数がかかっていた。
【００１８】そのため、このカバー穴５５１はコイルの調整のためには大きく、一方で不要輻射および飛び込みによる妨害が発生のためには小さくせねばならず、解決せねばならない課題であった。そこで本発明は調整精度が高く、しかも不要輻射や飛び込みの少ないものを提供することを目的とするものである。
【００１９】
【課題を解決するための手段】この目的を達成するために本発明の発振器の同調回路において、第１のインダクタンスを巻線コイルからなる調整用コイルとし、第２のイダンクタンスはプリントパターンからなる同調用パターンで形成するとともに、前記第１のインダクタンスと前記第２のインダクタンスとの間で相互インダクタンスを有するように対向させて配置する。
【００２０】
【作用】この構成より、第１のインダクタンスを巻線コイルとし、第２のインダクタンスはプリントパターンで形成しているので、カバー穴から見た調整用コイルは１個となり、従来のように他方の調整用コイルを気にすることなく発振周波数の調整が可能であり、またコイル調整時の発振周波数への変化量を小さくできるので、より少ない工数で精度よく発振周波数の調整が可能となる。
【００２１】さらに、前記第２のインダクタンスをプリントパターンとし反対面をアースパターンとすることにより、この前記第２のインダクタンスのプリントパターンからの不要輻射を低減することができる。
【００２２】
【実施例】以下本発明の実施例について図面を参照しながら説明する。図１は本発明の一実施例におけるＢＳチューナを示すブロック図である。
【００２３】図１において、ＢＳチューナ１４はダウンコンバータ部１２と、復調部１３とからなる。前記ダウンコンバータ部１２は、入力端子１に接続されたＲＦ増幅器２と、このＲＦ増幅器２と第１の発振器８とが入力されるミキサー３と、このミキサー３の出力に接続されたＩＦ増幅器４とからなる。
【００２４】前記復調部１３は、前記ＩＦ増幅器４に接続された位相比較器５と、この位相比較器５に接続されたループアンプ６と、このループアンプ６に接続されたビデオアンプ７と、前記ループアンプ６の出力に接続されたローパスフィルタ（以下ＬＰＦという）１０と、このＬＰＦ１０の出力に接続された前記第２の発振器９とからなり、この第２の発振器９の出力を前記位相比較器５に入力する。
【００２５】また前記ビデオアンプ７の出力は出力端子１１に接続している。次に動作について説明する。前記入力端子１を通してＢＳアンテナからの入力信号が前記ＲＦ増幅器２で増幅されて後に前記ミキサ３に入力される。
【００２６】このミキサー３に入力された信号は前記第１の発振器８により周波数変換され、前記ＩＦ増幅器４で増幅された後、前記位相比較器５と前記ループアンプ６と前記ＬＰＦ１０と前記第２の発振器９で構成される前記復調部１３で復調され、復調成分は前記ビデオアンプ７で増幅されて前記出力端子１１より出力される。
【００２７】図２は、前記第２の発振器９の詳細図である。図２では、バランス型発振回路７１と発振周波数を決定する同調回路７２を示す。
【００２８】初めにバランス型発振回路７１について説明する。トランジスタ５３および５４により差動増幅回路を構成し、そのエミッタは共に定電流源６０を通ってアース端子６３に接続する。
【００２９】前記トランジスタ５４のコレクタはコンデンサ５５を介して第１の出力端子６２に接続され、またこの第１の出力端子６２はコンデンサ５６を介して前記トランジスタ５３のベースに接続する。
【００３０】さらに、このトランジスタ５３のコレクタはコンデンサ５８を介して第２の出力端子６４に接続し、この第２の出力端子６４はコンデンサ５７を介して前記トランジスタ５４のベースに接続する。
【００３１】また、電圧供給端子６１に加えられた電圧は抵抗５１と５２を介してそれぞれ前記トランジスタ５３と５４に供給し、電圧制御端子６５にはループアンプの増幅回路５９の出力を接続する。
【００３２】次に前記同調回路７２について説明する。前記第１の出力端子６２とアースパターン間に設けた調整用コイル６６と、前記第２の出力端子６４とアースパターン間に設けた同調用パターン７０と、前記第１の出力端子６２と前記第２の出力端子６４との間にカソード同士を接続したバリキャップダイオード６７と６９の直

列回路とで構成する。
【００３３】さらに、この２つのバリキャップダイオード６７と６９の接続点と前記電圧制御端子６５との間には抵抗６８を設ける。
【００３４】以上の構成により、前記トランジスタ５３と５４とでバランス型発振回路を組み、前記コンデンサ５５と５６と５７と５８によって正帰還がかけられて、前記同調回路７２の中の前記調整用コイル６６と前記同調用パターン７０と前記２個のバリキャップダイオード６７と６９とで主に発振周波数が決定される。
【００３５】図３は、図２に示す本発明による第２の発振器の要部斜視図である。図３において、プリント基板１０７の上に、バランス型発振回路７１を含むＩＣ１０１と、このＩＣ１０１の第１の出力端子６２と第１のアースパターン１１１との間に接続した巻線コイルからなる調整用コイル６６と、第２の出力端子６４と第２のアースパターン１１２との間に接続したプリントパターンからなる同調用パターン７０と、前記第１の出力端子６２と前記第２の出力端子６４との間にカソード同士を接続したバリキャップダイオード６７と６９の直列回路を接続する。
【００３６】また、この２つのバリキャップダイオード６７と６９との接続点１１３と、電圧制御端子６５との間に抵抗６８を設けている。
【００３７】次に前記調整用コイル６６により発振周波数を調整する様子を図４で説明する。図４（ａ）は図３をカバーの上面Ａより見たものであり、図４（ｂ）は図３を側面Ｂから見たものである。
【００３８】図４（ａ）および図４（ｂ）において、金属フレーム２５５はプリント基板１０７のアースパターン２５７とは半田付けにより接続され、上面は金属カバー２５４と２５８とで覆われ、この金属カバー２５４にはコイル調整用のカバー穴２５１を設ける。
【００３９】この時に、前記調整用コイル６６の巻軸の方向と前記同調用パターン２５３とはほぼ平行に位置させ、かつ前記調整用コイル６６から前記同調用パターン７０の外側までの間隔Ｑは前記調整用コイル６６の外径Ｐに対して同等かそれ以下にしておく。
【００４０】但し、この時に前記調整用コイル６６の前記プリント基板１０７に対する浮きは無いものとして考えている。
【００４１】これにより、前記調整用コイル１０７と前記同調用パターン７０との間で発生している相互インダクタンスＭを、前記調整用コイル１０７を前記同調用パターン７０の方へ傾けることにより相互インダクタンスの変化分として△Ｍずつ可変でき、結果として同調回路のバランスをほとんどくずすことなく発振周波数の調整が可能となる。
【００４２】図４（ｃ）および（ｄ）では、図４（ａ）および（ｂ）において調整用コイルを一組の同調用パターンの方へ傾けて調整した後の状態を示す。
【００４３】図４（ａ），（ｂ），（ｃ），（ｄ）を用いて、前記調整用コイル６６から前記同調用パターン７０の外側までの間隔Ｑを前記調整用コイル６６の外径Ｐの約１／２に設定した場合について説明する。
【００４４】この設定により、前記調整用コイル６６と前記同調用パターン７０との間の相互インダクタンスＭを従来例に対し約１／２にでき、相互インダクタンスの変化△Ｍを従来例に対して１／２にできる。また、その時の前記調整用コイル６６による発振周波数の可変範囲は約１８ＭＨｚで、実際に必要な可変範囲の１０ＭＨｚに対して十分である。
【００４５】つまり、調整用コイルによる周波数の変化への感度を従来例の約１／２に設定でき、発振周波数の精度の良い調整が可能となる。
【００４６】また、図４（ａ）より明らかなように前記調整用カバー穴２５１より見えるコイルは１個の調整用コイル６６のみとなり、この調整用コイル６６を傾けて調整するので調整が容易であり、さらにはこの調整用カバー穴を小さくできるものであり不要輻射や飛び込みを改善できるものである。
【００４７】図５（ａ），（ｂ）では、図４（ａ），（ｂ）より同調回路のインダクタンスを構成するプリントパターンの反対面にアースパターンを設けた場合を示す。
【００４８】図５（ａ），（ｂ）において、金属フレーム２５５はプリント基板１０７のアースパターン３０７とは半田付けにより接続され、前記金属フレーム２５５は金属カバー２５４と２５８とで覆われ、この金属カバー２５４にはコイル調整用のカバー穴２５１を設ける。
【００４９】前記プリント基板１０７には調整用コイル６６と同調用パターン７０とを図４（ａ），（ｂ）と同じ位置関係におき、この同調用パターン７０の反対面には前記アースパターン３０７を置き、マイクロストリップラインの構成とする。
【００５０】これにより、前記同調用パターン７０によるインダクタンスから放出される不要輻射のレベルは低減される。
【００５１】図６は、図２に示す本発明による第２の発振器の要部斜視図であり、同調用パターンを構成するプリントパターンの形状の異なる場合を示す。
【００５２】図６において、プリント基板３５７の上に、バランス型発振回路を含むＩＣ１０１と、このＩＣ１０１の第１の出力端子６２とアースパターン１１１との間に接続した調整用コイル６６と、第２の出力端子６４とアースパターン１１２との間に接続した同調用パターン３５６と、前記第１の出力端子６２と前記第２の端子６４との間にカソード同士を直列接続したバリキャップダイオード６７と６９とを配置する。
【００５３】また、この２つのバリキャップダイオード

６７と６９との接続点１１３と、電圧制御端子６５との間に抵抗６８を設けている。

【００５４】前記調整用コイル６６により発振周波数を調整する様子を図７（ａ），（ｂ）で説明する。

【００５５】図７（ａ）は図６をカバーの上面Ａより見たものであり、図７（ｂ）は図６を側面Ｂから見たものである。

【００５６】図７（ａ）および（ｂ）において、金属フレーム２５５はプリント基板３５７のアースパターン４０７とは半田付けにより接続され、４０８，４０９，４１０等よりなる同調用パターン３５６の基板の反対面には前記アースパターン４０７を置く場合を示す。

【００５７】前記金属フレーム２５５は金属カバー２５８と２５４とで覆い、この金属カバー２５４にはコイル調整用のカバー穴２５１を設ける。

【００５８】この時に、前記同調用コイル６６に対向させて４０８～４１０よりなるコ字型の前記同調用パターン３５６を設ける。

【００５９】具体的には、前記調整用コイル６６より最も遠い同調用パターン部分４１０を調整用コイル６６の巻線の方向に対してほぼ平行に位置させ、前記同調用パターン部分４１０の一方にはこの同調用パターン部分４１０にほぼ直角に同調用パターン部分４０９を前記調整用コイル６６の方向へ接続し、前記同調用パターン部分４１０の他端には前記同調用パターン部分４１０にほぼ直角に同調用パターン部分４０８を前記調整用コイル６６の方向へ接続する。

【００６０】この時、前記調整用コイル６６の巻線部の外径Ｐと、前記調整用コイル６６から前記同調用パターン部分４１０の外側までの寸法Ｒとの関係はほぼＰ≧Ｒとし、さらに前記同調用パターン部分４１０の長さＳについてはほぼＰ≦Ｓとする。

【００６１】これにより、前記同調用パターン部分４０８および４０９および４１０のすべてが前記調整用コイル６６との間で相互インダクタンスを持つことになり、このＲ及びＳの設定によりコイル調整時の周波数の調整範囲および調整精度を選ぶことができる。

【００６２】図８及び図９では、本発明の一実施例である図７（ａ）の４０８，４０９，４１０から構成されている同調用パターンの形状の異なる場合を示す。

【００６３】図８において、金属カバー２５４には調整用のカバー穴２５１を設け、巻線コイルからなる調整用コイル６６とプリントパターンからなるジグザグ型の同調用パターン４５４とを設けている。

【００６４】この時、前記調整用コイル６６から前記同調用パターン４５４の外側までの寸法Ｖは、前記調整用コイル６６の外径Ｐに対してほぼ同じかそれ以下にする。

【００６５】これにより、前記調整用コイル６６と前記同調用パターン４５４の間での相互インダクタンスが、本発明の一実施例である図７（ａ）での相互インダクタンスより大きくとれ、コイル調整時の周波数の調整範囲および調整精度を選ぶことができる。

【００６６】図９において、金属カバー２５４には調整用のカバー穴２５１を設け、巻線コイルからなる調整用コイル６６と渦巻状にしたプリントパターンからなる同調用パターン４５４を設け、その中心部をアースパターン４７５に接続する。

【００６７】この時、前記調整用コイル６６から前記同調用パターン４７４の外側までの寸法Ｗは、前記調整用コイル６６の外径Ｐに対してほぼ同じかそれ以下にする。

【００６８】これにより、前記調整用コイル６６と前記同調用パターン４７４の間での相互インダクタンスが、本発明の一実施例である図７（ａ）での相互インダクタンスより大きくとれ、コイル調整時の周波数の調整範囲および調整精度を選ぶことができる。

【００６９】

【発明の効果】以上のように、本発明の発振器の同調回路によれば、第１のインダクタンスを巻線コイルからなる調整用コイルとし、第２のインダクタンスはマイクロストリップラインからなる同調用パターンで形成するとともに、前記第１のインダクタンスと前記第２のインダクタンスとの間で相互インダクタンスを有するように対向させて配置し、前記調整用コイルを前記インダクタンスの方へ傾けて調整する。

【００７０】これにより、カバー穴から見た調整用コイルは１個となり、従来のように他方のコイルを気にすることなく調整が可能なため調整用のカバー穴を小さくでき不要輻射や飛び込みによる妨害に対し有効な設計が可能である。

【００７１】さらに、マイクロストリップラインからなる同調用パターンと調整用コイルとからなる同調回路の構成により、調整時に最適な相互インダクタンスの変化量を設定でき発振周波数の精度の良い調整が可能となり、また同調回路にマイクロストリップラインを用いることにより同調回路からの発振成分の漏洩を大幅に低減できる。

【００７２】以上のように、本発明を採用することにより低コストで、かつ優れたバランス型発振器を持つ高周波装置を提供できるのである。

【図面の簡単な説明】

【図１】本発明の一実施例によるＢＳチューナを示すブロック図

【図２】同ＢＳチューナの第２の発振器の回路図

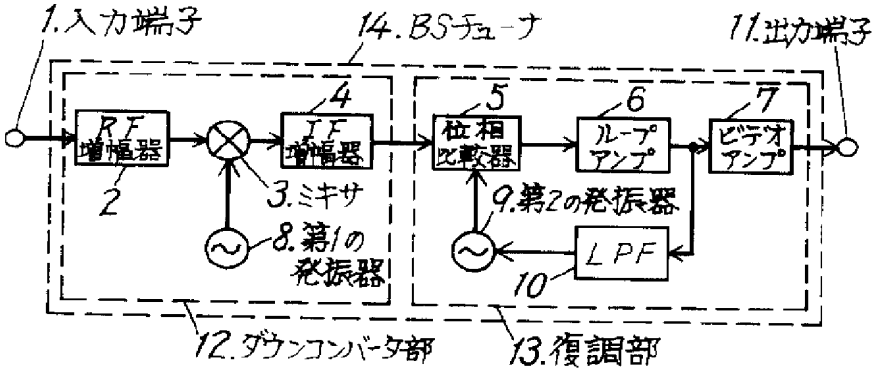
【図３】同ＢＳチューナの第２の発振器の要部斜視図

【図４】（ａ）は図３のコイルによる調整前の状態を、図３のカバーの上面Ａより見た上面図

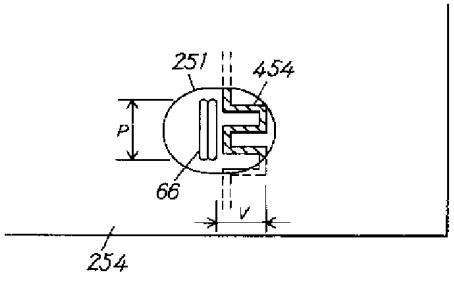
（ｂ）は図３のコイルによる調整前の状態を、図３の側面Ｂより見た断面図

（ｃ）は図３のコイルによる調整後の状態を、図３のカバーの上面Ａより見た上面図
（ｄ）は図３のコイルによる調整後の状態を、図３の側面Ｂより見た断面図
【図５】（ａ）は図４（ａ）に対応する他の実施例の上面図
（ｂ）は図４（ｂ）に対応する他の実施例の断面図
【図６】ＢＳチューナの第２の発振器の要部斜視図
【図７】（ａ）は図６のコイルによる調整前の状態を、カバーの上面Ａより見た上面図
（ｂ）は図６のコイルによる調整前の状態を、カバーの側面Ｂより見た断面図
【図８】同調用パターンの他の実施例の上面図
【図９】同調用パターンの他の実施例の上面図
【図１０】従来のＢＳチューナの第２の発振器の要部斜視図
【図１１】（ａ）は図１０のコイルによる調整前の状態を、カバーの上面Ａより見た上面図
（ｂ）は図１０のコイルによる調整前の状態を、カバーの側面Ｂより見た断面図
（ｃ）は図１１（ａ）のコイルによる調整後の状態を示す上面図
（ｄ）は図１１（ｂ）のコイルによる調整後の状態を示す断面図
【符号の説明】
１　入力端子
９　第２の発振回路
１１　出力端子
１２　ダウンコンバータ部
１３　復調部
６２　第１の出力端子
６４　第２の出力端子
６６　調整用コイル
６７　バリキャップダイオード
６９　バリキャップダイオード
７０　同調用パターン
７１　バランス型発振回路
７２　同調回路

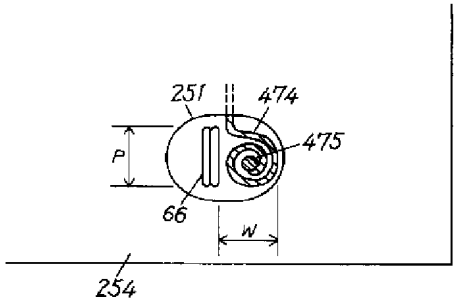
【図１】



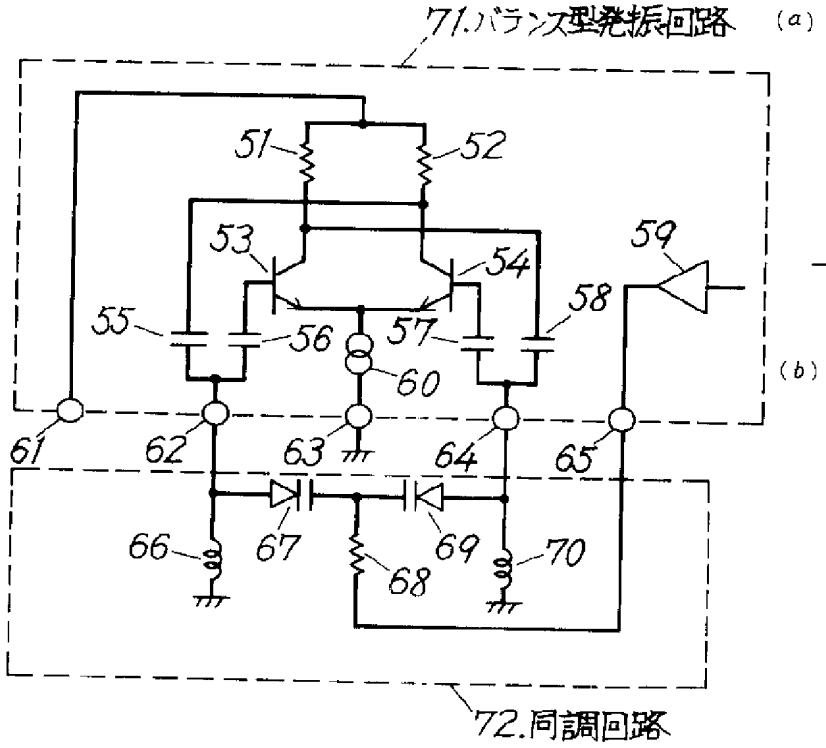
【図８】



【図９】



【図２】


71.バランス型発振回路
(a)
51
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(b)
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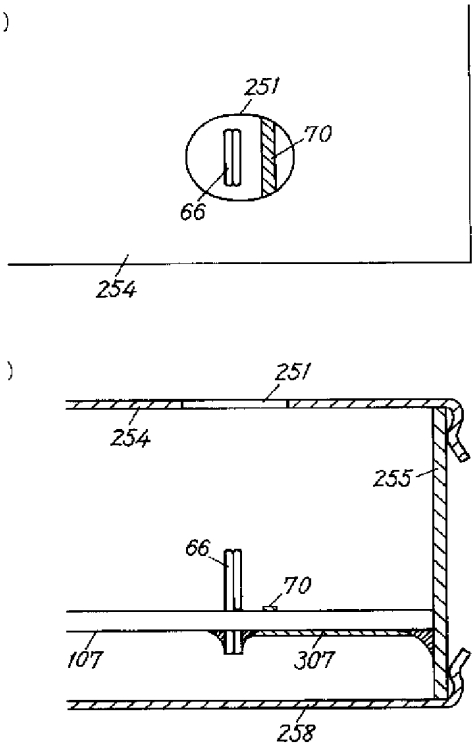
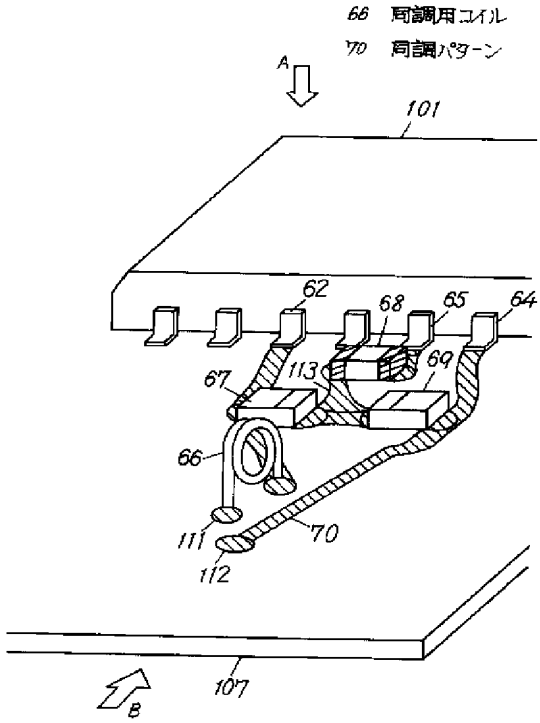
68
69
70
72.同調回路

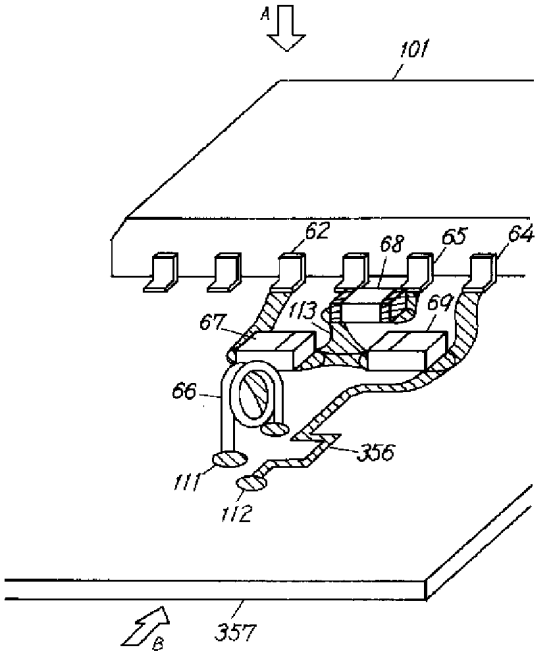
【図５】


251
70
66
254
251
254
255
66
70
107
307
258

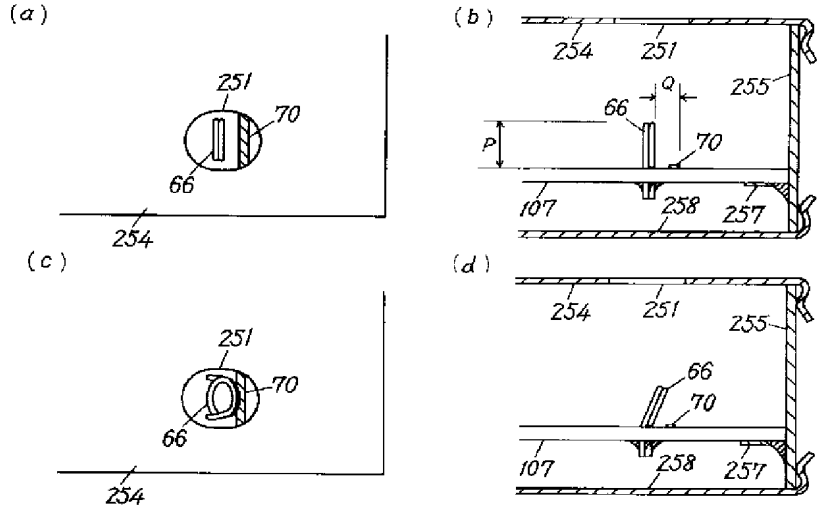
【図３】


66 同調用コイル
70 同調パターン
A
101
62
68
65
64
67
113
69
66
111
112
70
B
107

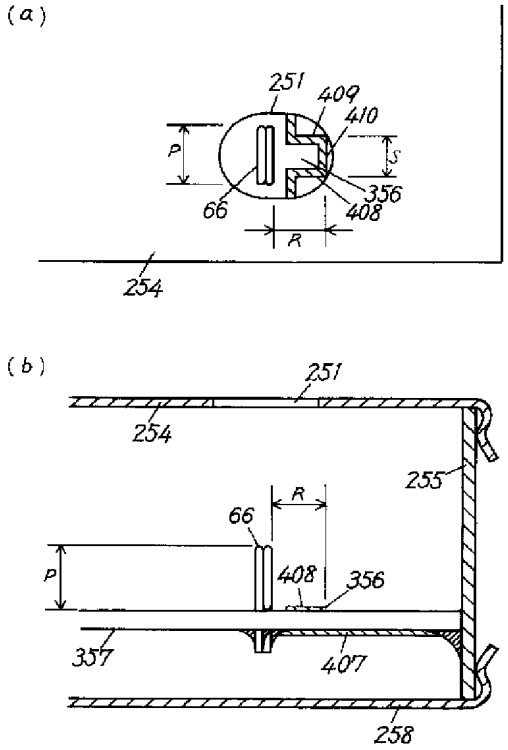
【図６】


A
101
62
68
65
64
67
113
69
66
356
111
112
B
357

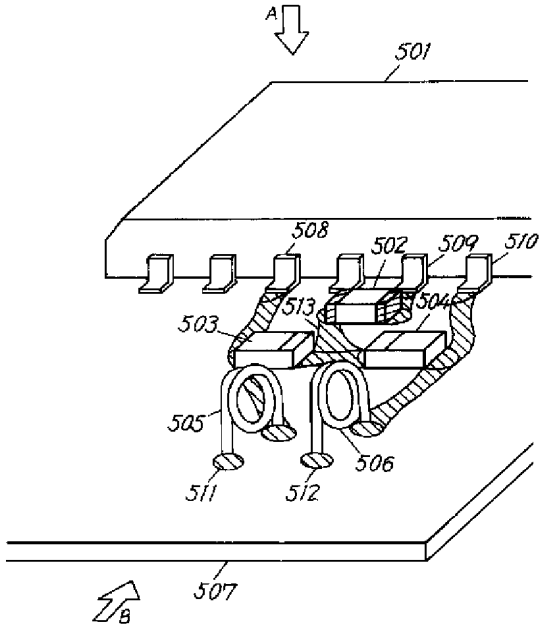
【図４】


(a)
251
70
66
254
(b)
254
251
Q
255
66
70
P
107
258
257
(c)
251
70
66
254
(d)
254
251
255
66
70
107
258
257

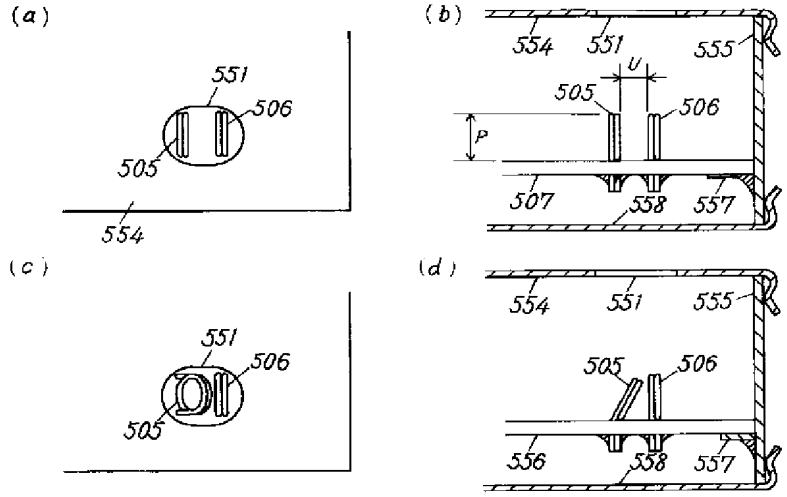
【図７】


(a)
251
409
410
S
P
356
66
408
R
254
(b)
251
254
255
R
66
P
408
356
357
407
258

【図１０】


A
501
508
502
509
510
513
504
503
505
506
511
512
507
B

【図１１】


(a)
551
506
505
554
(b)
554
551
555
U
505
506
P
507
558
557
(c)
551
506
505
(d)
554
551
555
505
506
556
558
557